AUDIT REPORT

MISSOURI DEPARTMENT OF TRANSPORTATION
CONDITION OF MISSOURI'S HIGHWAY INFRASTRUCTURE AND RELATED EXPENDITURES

From The Office Of State Auditor
Claire McCaskill

Report No. 2001-82
September 6, 2001
www.auditor.state.mo.us

Office Of The
State Auditor Of Missouri
Claire McCaskill

September 2001

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YELLOW SHEET

The following conditions were reported related to an audit conducted by our office of the Missouri Department of Transportation, Condition of Missouri's Highway Infrastructure and Related Expenditures.

Missouri's roads and bridges are deteriorating and generally are in worse condition than those in neighboring states, partly because Missouri is responsible for a larger highway system than neighboring states with the sixth largest in the nation. This, coupled with the relatively low motor fuel tax rates, has resulted in Missouri receiving less revenues for highway purposes and expending less money (on a per mile basis) than its neighbors.

The Missouri Department of Transportation (MoDOT) is responsible for approximately 26 percent of all roads in the state; however, about 70 percent of vehicle travel in the state is on these roads. In 1999, according to federal highway statistics, capital outlay and maintenance accounted for about 62 and 21 percent, respectively, of total department expenditures.

On a nationwide basis, Missouri ranks near the bottom in revenue per mile. In 1999, all neighboring states except Arkansas received more funds for highway purposes than Missouri, and Missouri was well below the national average of $110,255 per mile. Some neighboring states had sources of highway revenue not being received by Missouri, including toll fees and bond proceeds.

Motor fuel tax receipts represented approximately 40 percent of Missouri's total highway revenue. Missouri's motor fuel tax of 17 cents per gallon for both gasoline and diesel is lower than most neighboring states. Considering the relatively low level of revenue available to the MoDOT to allocate to the highway system, Missouri's resources to maintain and improve the state's road system are limited. To address this situation, it was recommended that MoDOT work with the legislature to explore the possibilities of increasing the revenues available for highway purposes.

In addition, we concluded that MoDOT may not be applying a sufficient percentage of its revenues in preserving and maintaining the state's existing infrastructure system. The MoDOT has allocated a smaller percentage of funds to preservation activities than several of its neighboring states, even considering an increase in these activities in 1999. In addition, the department's accounting system does not adequately identify detailed cost information regarding its preservation and maintenance activities and the department has not established a system of performance goals and measures related to these activities.

(over)

Related Information

- In December 1999, 83 percent of Missouri roads on the National Highway System were ranked as fair, poor or very poor, including interstate roads of which 43 percent were rated as poor or very poor.

- During the period from 1996 to 1999, the percentage of Missouri roads rated as good or better was decreasing, while the percentage of roads rated good or better for the neighboring states and the nation was increasing. By 1999, Missouri roads rated as poor or very poor were higher than the neighboring states and the nation.

- From 1995 to 1999, the percentage of roads rated as very good was declining at a rapid rate, while the roads rated as poor and/or very poor were increasing at a slower rate. As a result, the department has a backlog of pavement in fair or worse condition which is in need of repair.

- As of December 1999, 19 percent of the state-owned bridges were classified as structurally deficient and 14 percent were classified as functionally obsolete. In addition, Missouri had off-system bridges in which 36 percent were structurally deficient and 10 percent were functionally obsolete. MoDOT receives federal monies that are passed on to the cities, counties and townships for the purpose of maintaining the off-system bridges.

- Missouri ranks seventh in the nation in the percentage of substandard bridges. Missouri has consistently had more substandard bridges than the average for the neighboring states and the nation, for the years 1996 through 1999. In 1999, Missouri ranked first compared to its neighboring states for highest percentage of total substandard bridges. Only Oklahoma has a higher percentage of structurally deficient bridges.

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CLAIRE C. McCASKILL
Missouri State Auditor

Honorable Bob Holden, Governor
and
Missouri Highway and Transportation Commission
and
Henry Hungerbeeler, Director
Missouri Department of Transportation
Jefferson City, MO 65102

We have audited certain aspects of the Condition of Missouri's Highway Infrastructure and Related Expenditures as administered by the Missouri Department of Transportation (MoDOT). The objectives of this audit were to:

1. Review various aspects of Missouri's highway system and funding, and compare Missouri's highway data to other states with respect to:

   - Size and characteristics of the highway system.
   - The condition of roads and bridges and to determine whether the condition of Missouri's roads and bridges is declining.
   - Capital outlay and maintenance costs.
   - Highway revenues.
   - The level of preservation/preventive maintenance expenditures.

2. Determine if MoDOT's accounting system adequately accumulates and reports preservation and maintenance costs.

3. Determine if a system of performance goals and measures has been established for these activities.

Our audit was made in accordance with applicable standards contained in *Government Auditing Standards,* issued by the Comptroller General of the United States, and included such procedures as we considered necessary in the circumstances. In this regard, we interviewed

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department personnel, reviewed various internal and public documents and records, analyzed and compared data obtained from department personnel and from the computerized transportation management systems, and reviewed various federal highway publications.

As part of our audit, we assessed the department's management controls to the extent we determined necessary to evaluate the specific matters described above and not to provide assurance on these controls. With respect to management controls, we obtained an understanding of the design of relevant policies and procedures and whether they have been placed in operation and we assessed control risk.

Our audit was limited to the specific matters described above and was based on selective tests and procedures considered appropriate in the circumstances. Had we performed additional procedures, other information might have come to our attention that would have been included in this report.

The accompanying Management Advisory Report presents our findings arising from our audit of the Missouri Department of Transportation, Condition of Missouri's Highway Infrastructure and Related Expenditures.

Claire McCaskill
State Auditor

April 6, 2001 (fieldwork completion date)

The following auditors participated in the preparation of this report:

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EXECUTIVE SUMMARY

MISSOURI DEPARTMENT OF TRANSPORTATION
CONDITION OF MISSOURI'S HIGHWAY INFRASTRUCTURE AND
RELATED EXPENDITURES
EXECUTIVE SUMMARY

The Missouri Department of Transportation (MoDOT) is responsible for planning, designing, maintaining, and operating a safe and efficient highway and bridge transportation system. According to the Federal Highway Administration's (FHWA) 1999 Highway Statistics, the MoDOT was responsible for over 32,000 miles of roads and 9,900 bridges, and was sixth in the nation in state-administered lane miles. The MoDOT is responsible for approximately 26 percent of all roads in the state; however, about 70 percent of vehicle travel in the state is on these roads. In addition, travel on Missouri's roads has increased 16 percent from 1994 to 1999, while population has only increased about 4 percent during this period. On a nationwide basis, Missouri ranks near the bottom in revenue per mile. In 1999, according to federal highway statistics, capital outlay and maintenance accounted for about 62 and 21 percent, respectively, of total department expenditures.

The Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA) created the National Highway System (NHS) designation and other federal-aid highway categories. The NHS includes the Interstate System routes, a large percentage of urban and rural principal arterials, the Strategic Highway Network, and major connectors. Missouri has approximately 4,300 miles of road in the NHS. Currently, the Transportation Equity Act for the 21st Century (TEA-21) authorizes the federal highway programs for 1998-2003. The federal government, through the FHWA, assists states in paying the costs of road and bridge projects. The FHWA reimburses states for eligible road and bridge projects, and although the federal reimbursement rates vary depending on the type of projects, states generally are reimbursed for 80 percent of eligible costs. To obtain federal funds, states must follow certain FHWA requirements.

By most accounts, the highway infrastructure in Missouri is in rough shape. Missouri's roads and bridges are deteriorating and generally are in worse condition than those in neighboring states. To a great extent, this appears attributable to the fact that Missouri is responsible for a larger highway system than the neighboring states and one of the largest in the nation. This, coupled with the relatively low motor fuel tax rates, has resulted in Missouri receiving less revenues for highway purposes and expending less money (on a per mile basis) than its neighboring states.

MoDOT may not be applying a sufficient percentage of its revenues in preserving and maintaining the state's existing infrastructure system. In addition, MoDOT's accounting system does not provide complete and accurate information regarding its preservation and maintenance activities, nor has the department established a system of performance goals and measures related to these activities.

To improve the condition of Missouri's roads and bridges, MoDOT needs to work with the legislature to explore the possibilities of increasing the revenues available for highway purposes. In addition, MoDOT should increase the level of funding allocated for preservation and preventive maintenance activities. Also, the department needs to implement a system of activity

based accounting to accurately accumulate and report preservation and maintenance activities and establish a system of performance goals and measures related to these activities.

MANAGEMENT ADVISORY REPORT

MISSOURI DEPARTMENT OF TRANSPORTATION
CONDITION OF MISSOURI'S HIGHWAY INFRASTRUCTURE AND
RELATED EXPENDITURES

The state of Missouri has the sixth largest highway system in the United States (based on lane-miles). In addition, MoDOT is responsible for more total miles of road, as well as total lane miles, than any of its neighboring states (based on 1999 information) as presented below:

	Total Miles of Roads	**National Ranking**	**Total Lane – Miles**	**National Ranking**
Missouri	32,407	7	69,794	6
Arkansas	16,366	12	35,841	16
Illinois	16,353	13	41,863	12
Iowa	9,715	28	23,712	27
Kansas	10,386	25	23,799	26
Kentucky	27,477	8	60,488	8
Nebraska	9,971	26	22,105	29
Oklahoma	12,276	17	29,105	18
Tennessee	13,811	16	35,001	17

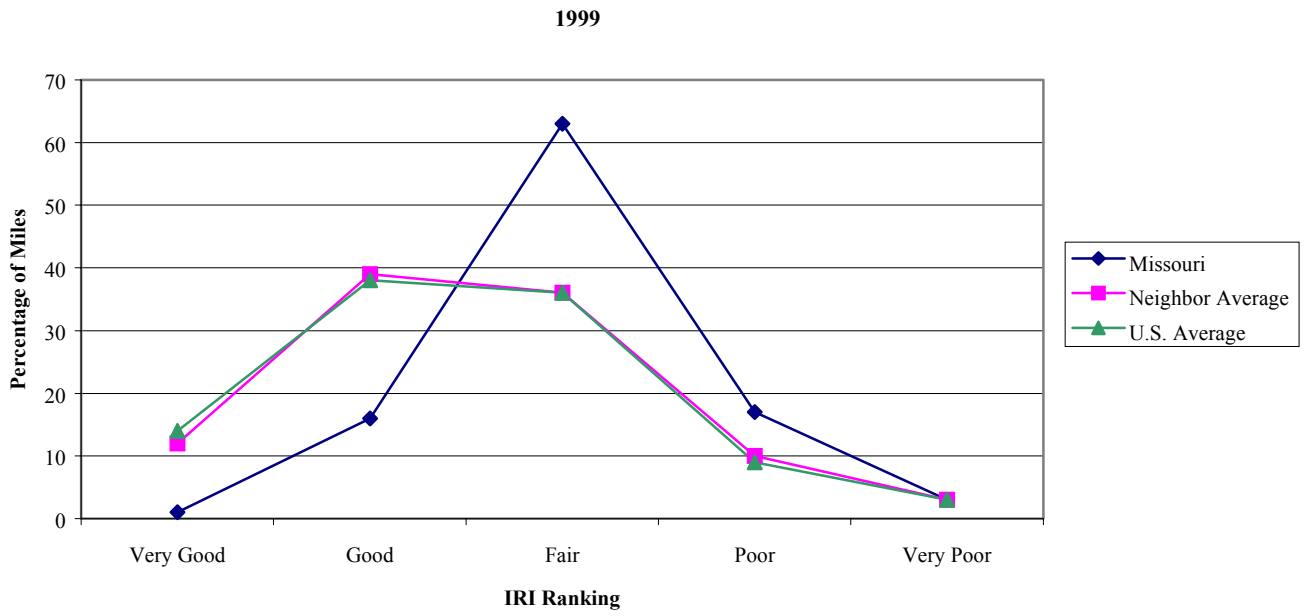
Information regarding the number of state-owned bridges in neighboring states was not readily available; therefore, comparative data regarding bridges is not presented.

Using various reports and information obtained from the department's data systems (particularly the computerized transportation management systems for pavement and bridge) and department personnel; information from the FHWA's Highway Statistics for 1999, 1998, 1997, and 1996 (2000 information has not been issued); and other relevant transportation literature, we analyzed the condition of Missouri roads and bridges and the amount of funds spent on preservation and maintenance activities as compared to neighboring states. We also evaluated the condition of Missouri's roads and bridges and the funding of preservation and maintenance activities over the last several years. Additionally, we compared Missouri highway revenues to those of neighboring states. On a limited basis, we performed test work to determine the reliability of the department's data that we used in this report. Our audit disclosed the following:

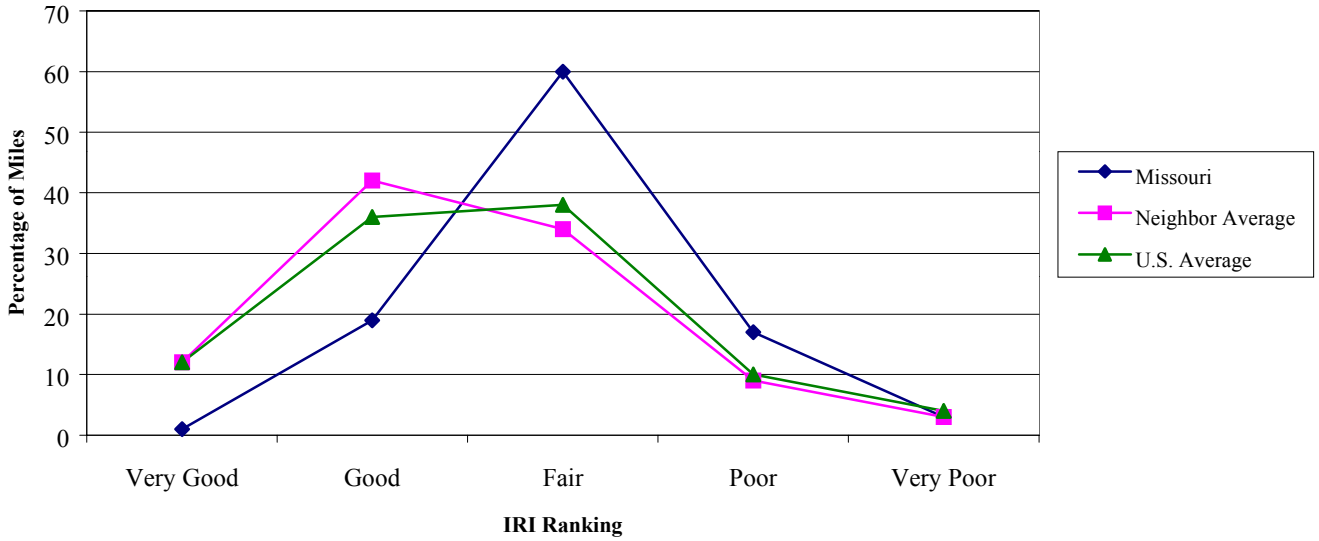
A. Condition of Missouri's Road and Bridge Infrastructure

1. To compare the condition of Missouri roads with its eight neighboring states (Arkansas, Illinois, Iowa, Kansas, Kentucky, Nebraska, Oklahoma, and Tennessee), International Roughness Index (IRI) data was obtained for each state and the U.S. average, for the NHS. The IRI is a measure of pavement roughness (ride quality) which is reported for all states in the FHWA's annual Highway Statistics reports. According to the FHWA, IRI is an objective measure of pavement roughness and is accepted as a standard in the pavement evaluation community.

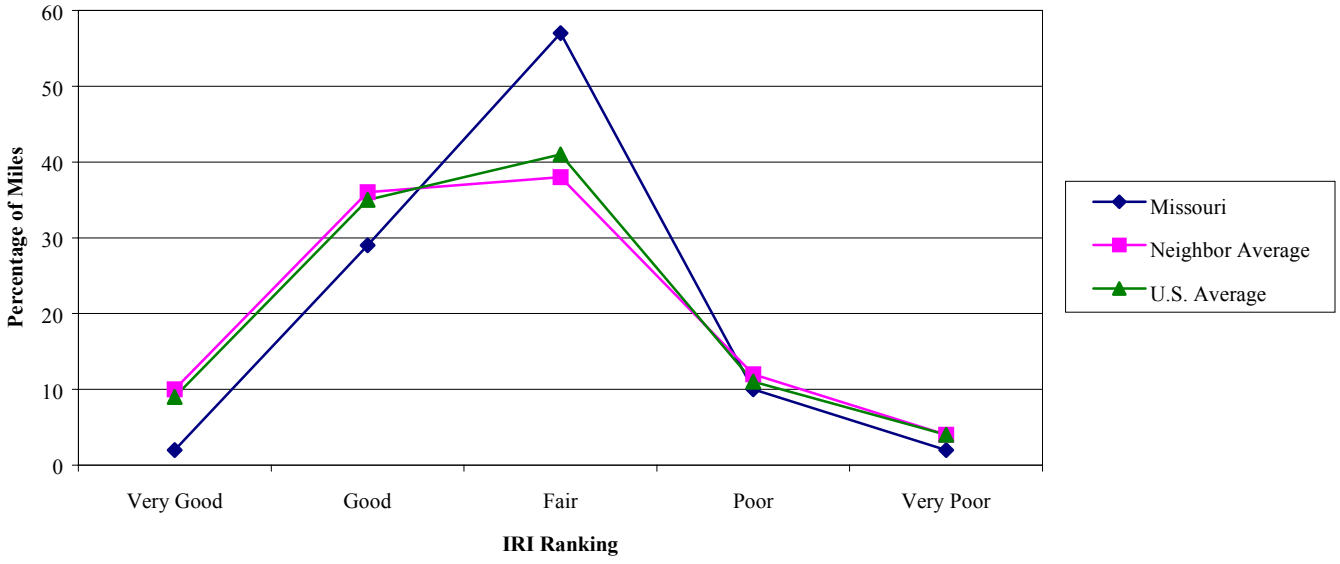
   As presented below, the percentage of Missouri roads included in the NHS rated as good or better is lower than those in the neighboring states and the nation, while the percentage of roads rated fair is higher. In Missouri, approximately 4,300 miles of road are included in the NHS. During the period from 1996 to 1999, the percentage of Missouri roads rated as good or better was decreasing, while the percentage of roads rated good or better for the neighboring states and the nation was increasing. Thus, during this time, the condition of Missouri roads was declining, and by 1999, Missouri roads rated as poor or very poor were higher than the neighboring states and the nation. In December 1999, 83 percent of Missouri roads on the NHS were ranked as fair, poor or very poor. Included in these roads are interstate roads of which 43 percent were rated as poor or very poor.

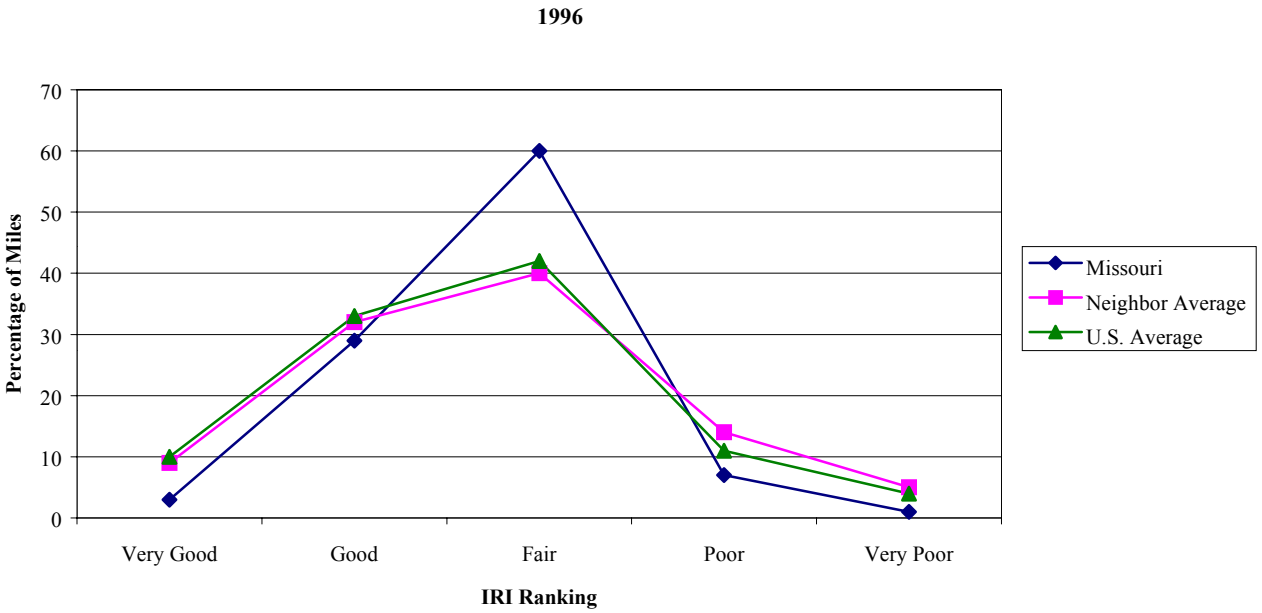


1998


70
60
50
40
30
20
10
0
Percentage of Miles
Very Good
Good
Fair
Poor
Very Poor
IRI Ranking
Missouri
Neighbor Average
U.S. Average

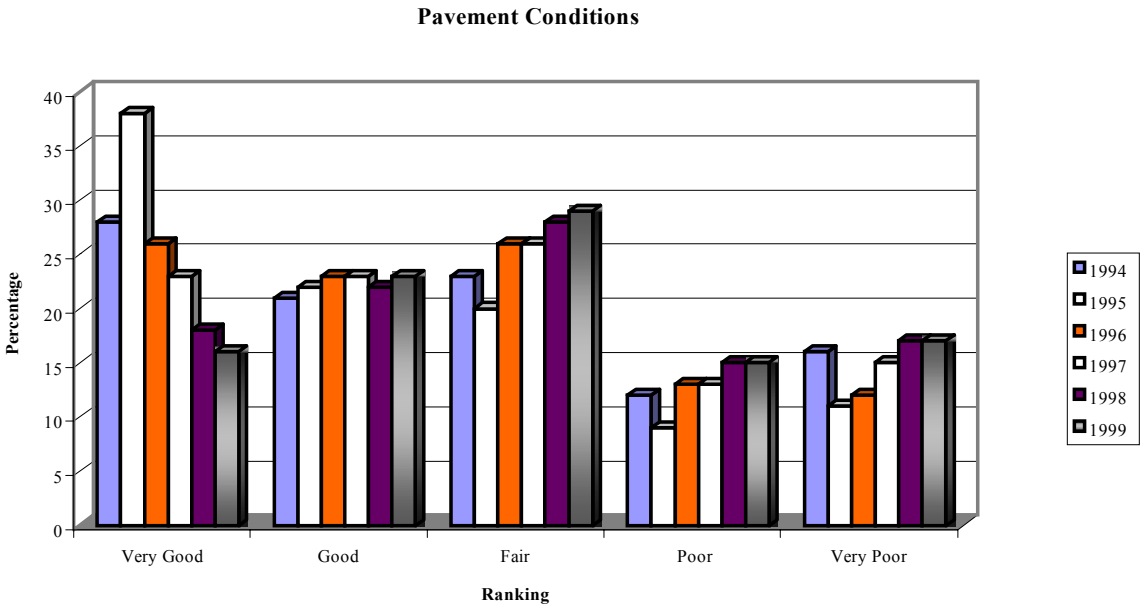
1997


60
50
40
30
20
10
0
Percentage of Miles
Very Good
Good
Fair
Poor
Very Poor
IRI Ranking
Missouri
Neighbor Average
U.S. Average



2. We also analyzed the condition of all Missouri roads (over 32,000 miles of road) for which the MoDOT is responsible using the department's pavement system. For internal reporting and ranking, the MoDOT uses a Present Serviceability Rating (PSR), which does not incorporate the IRI. The PSR measures the quality of pavement based upon an assessment of ride and road conditions, and includes distress factors such as rutting, patching, raveling, spalling, and joint conditions. The MoDOT classifies its roads as very good, good, fair, poor, and very poor based upon the numerical calculation of the PSR (pavement) index.

   The condition of Missouri roads from 1994 to 1999, as measured by the department's pavement index, is presented below:



From 1995 to 1999, the percentage of roads rated as very good was declining at a rapid rate, while the roads rated as poor and/or very poor were increasing at a slower rate. As a result, the MoDOT has a backlog of pavement in fair or worse condition which is in need of repair.

3. The FHWA identifies two type of substandard bridges: 1) structurally deficient and 2) functionally obsolete. These classifications do not necessarily mean that a bridge is unsafe; however, they do provide a measure of the physical condition and limitation of the state's bridges.

These classifications are described as follows:

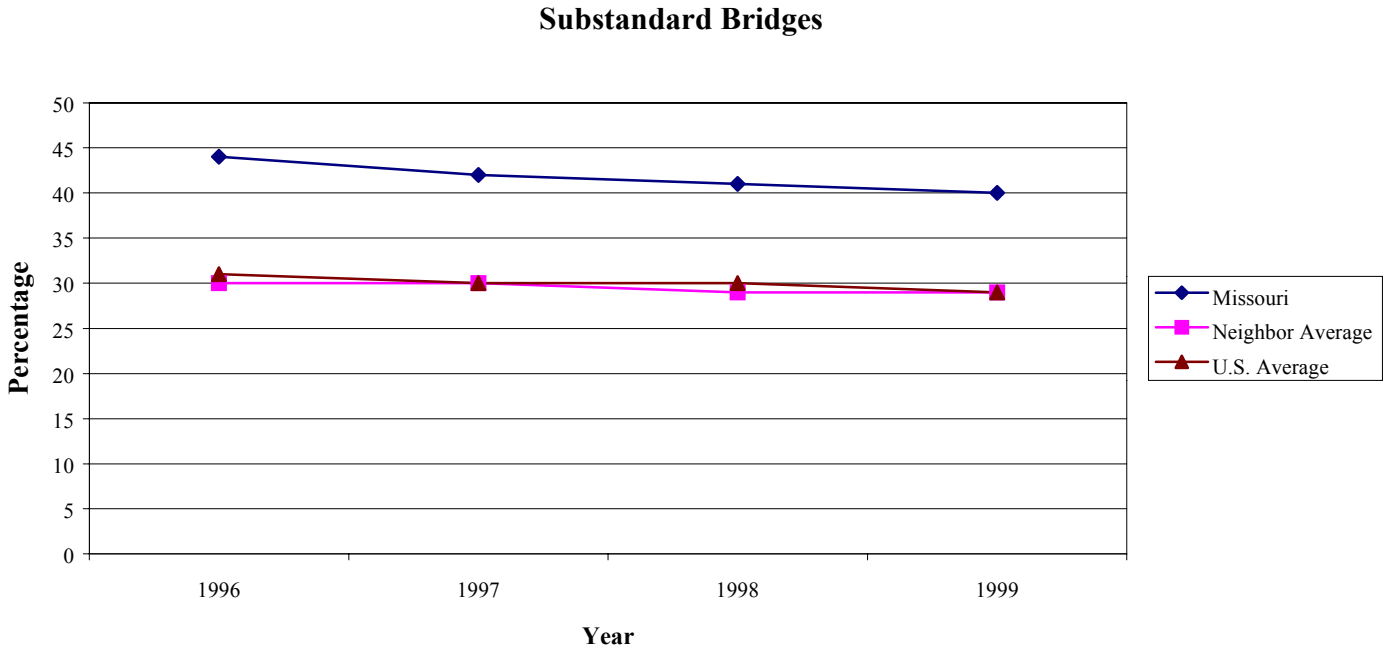
- A **structurally deficient bridge** is one that (1) has been restricted to light vehicles only, (2) is closed, or (3) requires immediate rehabilitation to remain open.

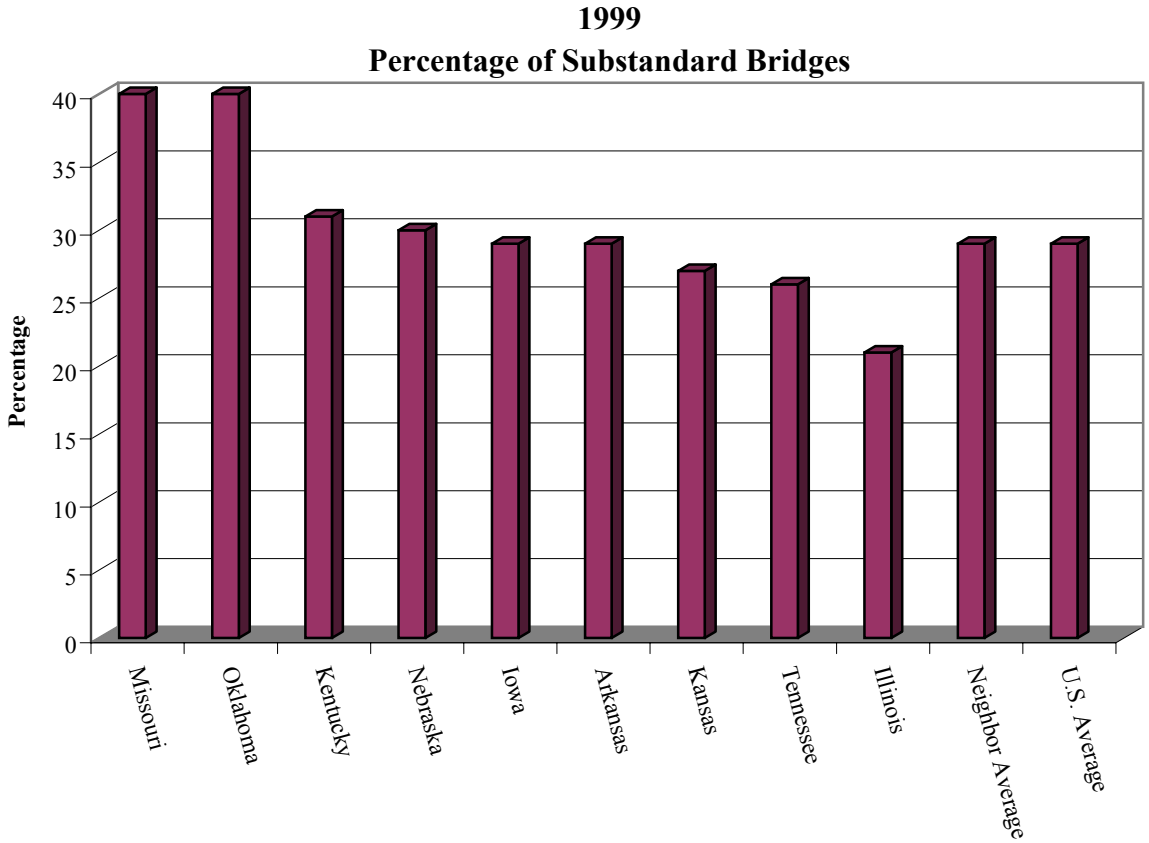
- A **functionally obsolete bridge** is one on which the deck geometry, load-carrying capacity, vertical and horizontal clearance, and/or approach roadway alignment no longer meets the usual criteria for the system of which it is a part. Although bridges classified as being functionally obsolete typically have too few or too narrow lanes, poorly aligned approaches, or restrictive overhead clearances, they are not necessarily structurally unsound. However, a functionally obsolete bridge can cause delays or traffic congestion, as well as pose a hazard to the traveling public.

As of December 1999, 1,837 (19 percent) of the 9,900 state-owned bridges were classified as structurally deficient and 1,411 (14 percent) were classified as functionally obsolete. Included in the 9,900 state-owned bridges is approximately 350 pedestrian and railroad bridges. States also have off-system bridges which are bridges owned by cities, counties, and/or townships. The MoDOT receives federal monies that are passed on to the cities, counties and townships for the purpose of maintaining these bridges. As of December 1999, Missouri had 13,293 off-system bridges in which 4,789 (36 percent) were structurally deficient and 1,354 (10 percent) were functionally obsolete.

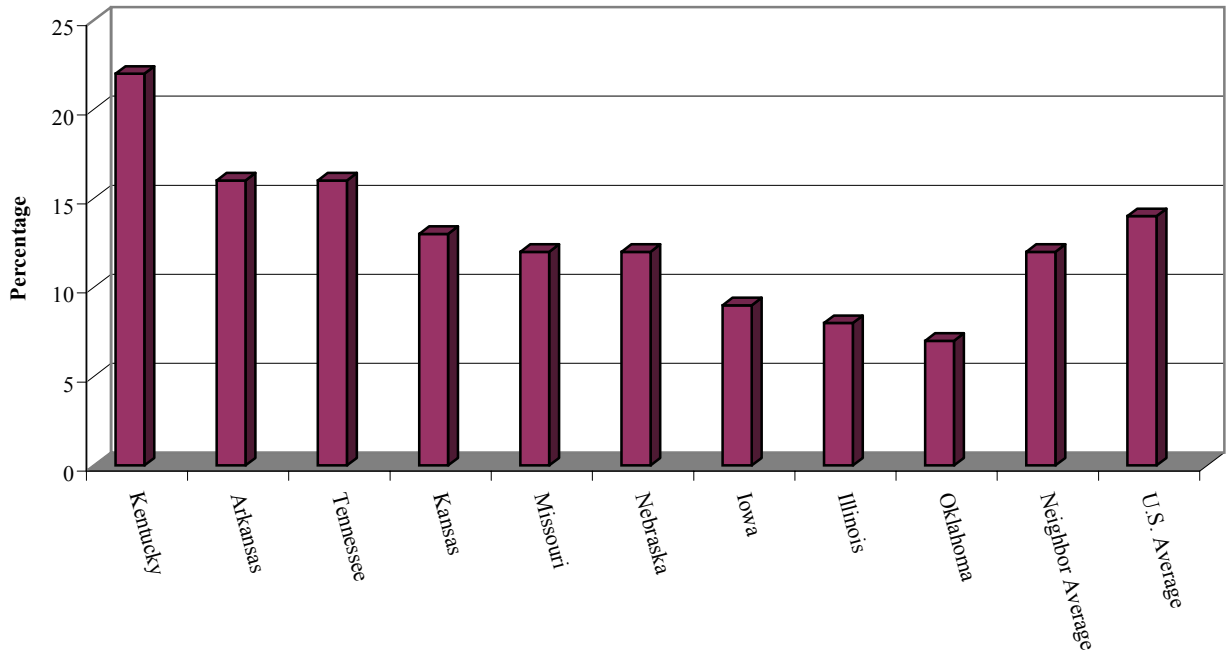
From FHWA bridge inventory (state-owned and off-system) data, we compared the condition of Missouri's bridges to the condition of bridges in the eight neighboring states and the nation, as presented below:

1996 to 1999

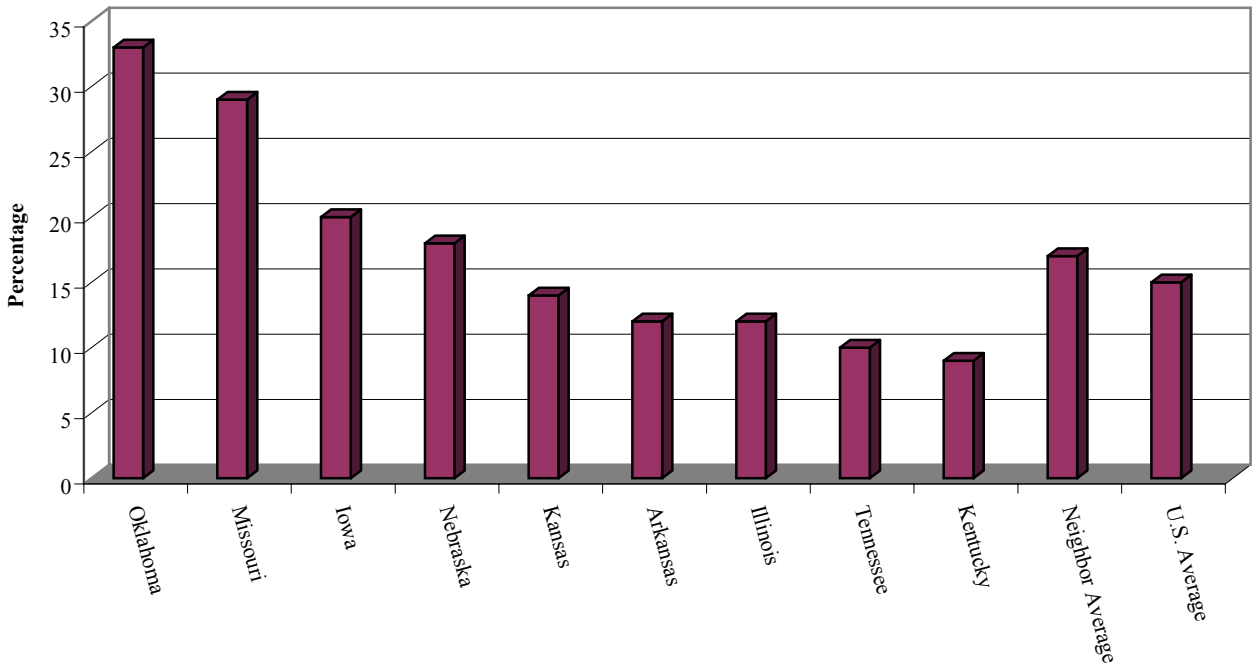

Substandard Bridges
Percentage
50
45
40
35
30
25
20
15
10
5
0
1996
1997
1998
1999
Year
Missouri
Neighbor Average
U.S. Average


1999
Percentage of Substandard Bridges
Percentage
40
35
30
25
20
15
10
5
0
Missouri
Oklahoma
Kentucky
Nebraska
Iowa
Arkansas
Kansas
Tennessee
Illinois
Neighbor Average
U.S. Average

1999
Percentage of Functionally Obsolete Bridges

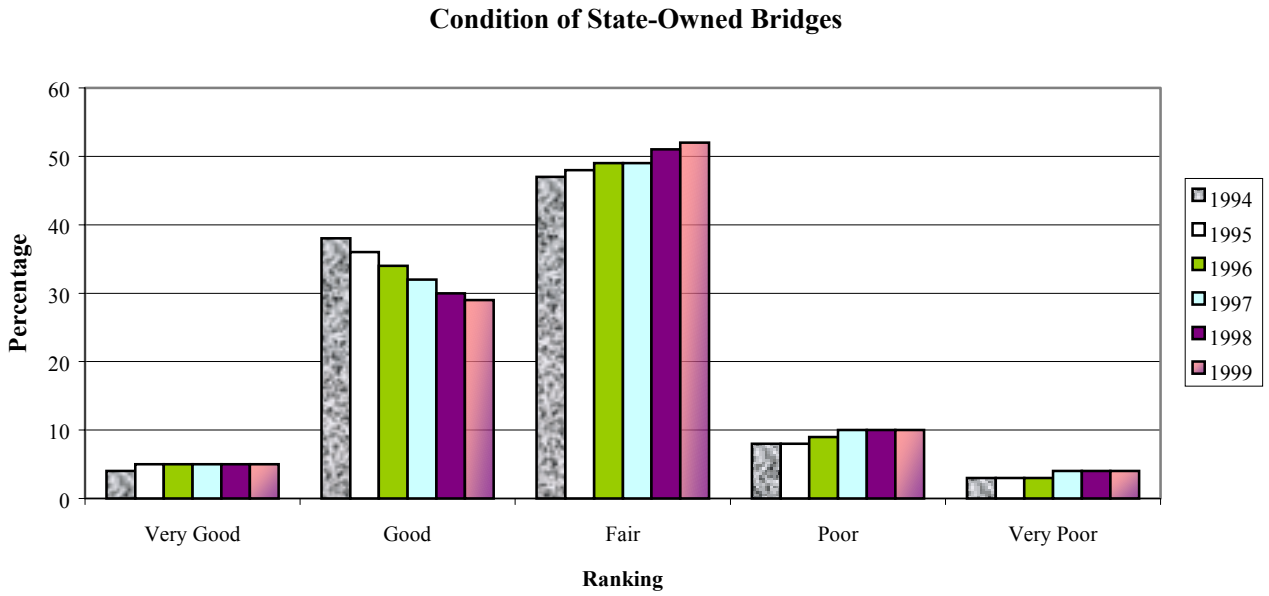


1999
Percentage of Structurally Deficient Bridges



Although the percentage of substandard (structurally deficient and functionally obsolete) bridges for the nation, as a whole, has decreased slightly from 1996 to 1999, Missouri has consistently had more substandard bridges than the average for the neighboring states and the nation, for these years. In 1999, Missouri ranked first compared to its neighboring states for highest percentage of total substandard bridges. Over 70 percent of these substandard bridges are structurally deficient. Only one other state in the U.S. (Oklahoma) has a higher percentage of structurally deficient bridges. Overall, Missouri ranks seventh in the nation in the percentage of substandard bridges.

4. The MoDOT tracks the condition of state-owned bridges through its bridge management system (bridge index). State-owned bridges, for which the MoDOT is responsible, represent about 43 percent of all bridges in Missouri. Using the bridge index, we analyzed the condition of state-owned bridges from 1994 to 1999, as presented below:



From 1994 to 1999, the percentage of bridges classified as very good or good was decreasing. As a result, in 1999 only about 35 percent of MoDOT's bridges were in very good or good condition.

The department also prepares a "condition 3" list of span-type bridges. This list identifies the highest priority bridge structures which are classified as very poor and in most need of repair, rehabilitation, and/or replacement, and represents the backlog of priority bridges. In 1999, there were 411 bridges (6 percent) of the 6,983 state-owned span-type bridges on the condition 3 list. From 1994 to 1999, the number of bridges on this list has increased by 120, or 41 percent.

We also reviewed the age of the approximately 9,900 state-owned bridges, including span-type, culverts, pedestrian, and railroad. Over 2,300 bridges (approximately 24 percent) were built more than 60 years ago. Approximately 77 percent of these 2,300 bridges have not received any type of major repair and/or reconstruction since they were built.

Based on the information presented above, it is apparent the condition of Missouri's road and bridge infrastructure has deteriorated in recent years. Fewer roads and bridges are classified as very good or good each year, and the condition of the state's roads and bridges are not in as good condition as the neighboring states and the nation-wide average.

B. Highway Expenditures

1. The FHWA's Highway Statistics reports classify and define the various types of highway expenditures as follows:

- **Capital outlays (construction/preservation)** are those costs associated with highway improvements such as land acquisition and other right-of-way costs; preliminary and construction engineering; construction and reconstruction; resurfacing, rehabilitation, and restoration; system preservation activities; and installation of traffic service facilities such as guard rails, fencing, signs, and signals.

- **Maintenance costs** are those required to preserve and keep the entire highways, including surface, shoulders, roadside structures, and traffic control devices in usable condition and as close as possible to its original condition as designed and constructed. These costs include preventive maintenance activities which extend pavement and bridge service life to at least achieve the design life of the facility.

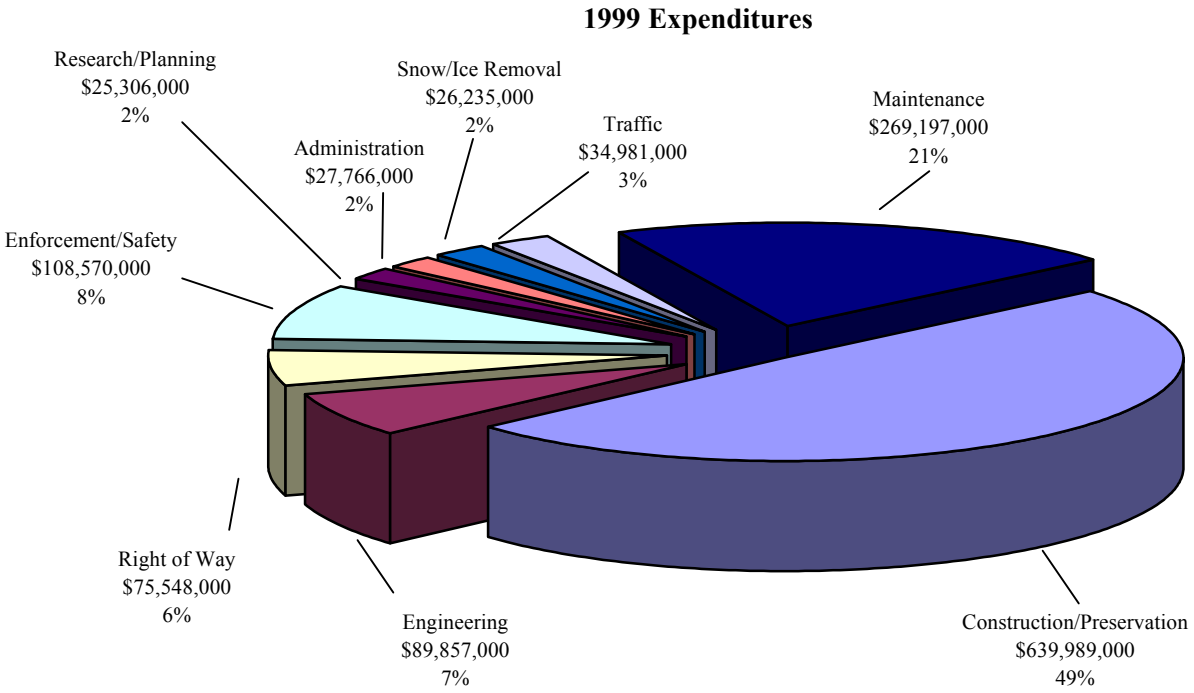
- **Highway and traffic services costs** are those associated with the operation and management of highways. These costs are classified as 1) expenditures for operating traffic control and surveillance systems for monitoring and controlling traffic flow; 2) expenditures for snow and ice removal; 3) expenditures for highway beautification, litter control, vegetation management, erosion control, and air quality programs.

- **Administration costs** are the general expenses of administering the highway program, including general overhead; engineering; and research costs that are not assigned to specific road projects. These costs also include expenses for highway planning and research, highway litigation, and highway publications.

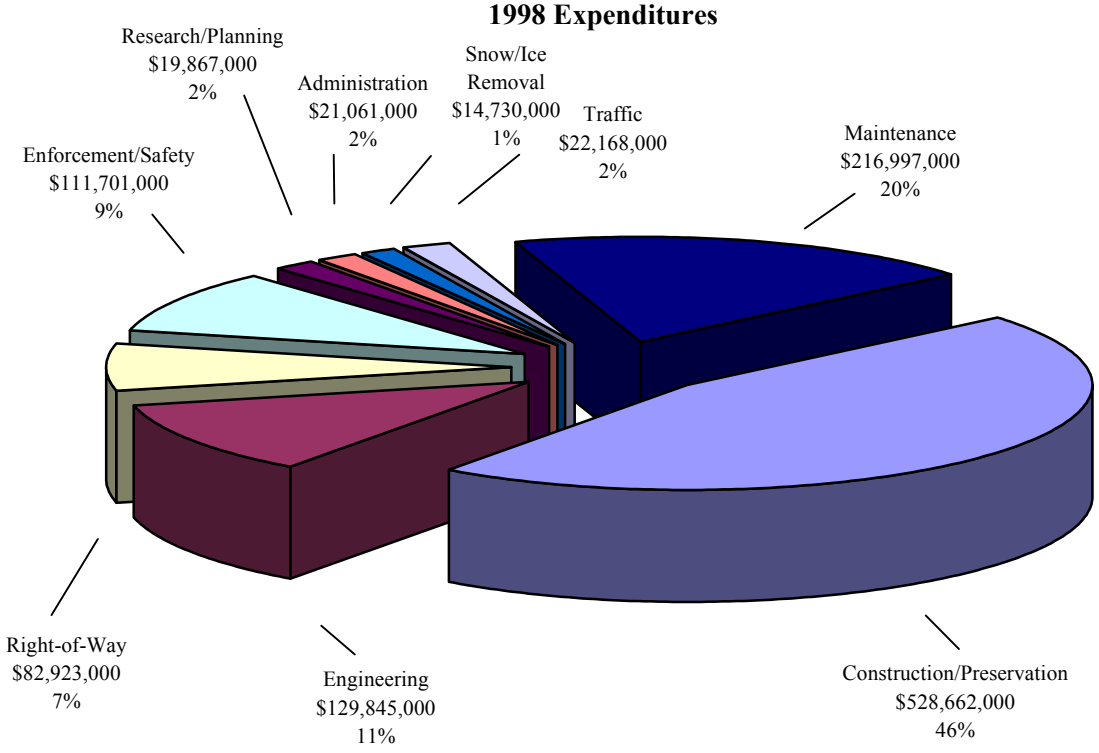
- **Highway law enforcement and safety** are those costs related to the traffic supervision of the state highway patrol; programs for driver

education and training and motorcycle safety; vehicle inspection programs; and enforcement of vehicle size and weight limitations.

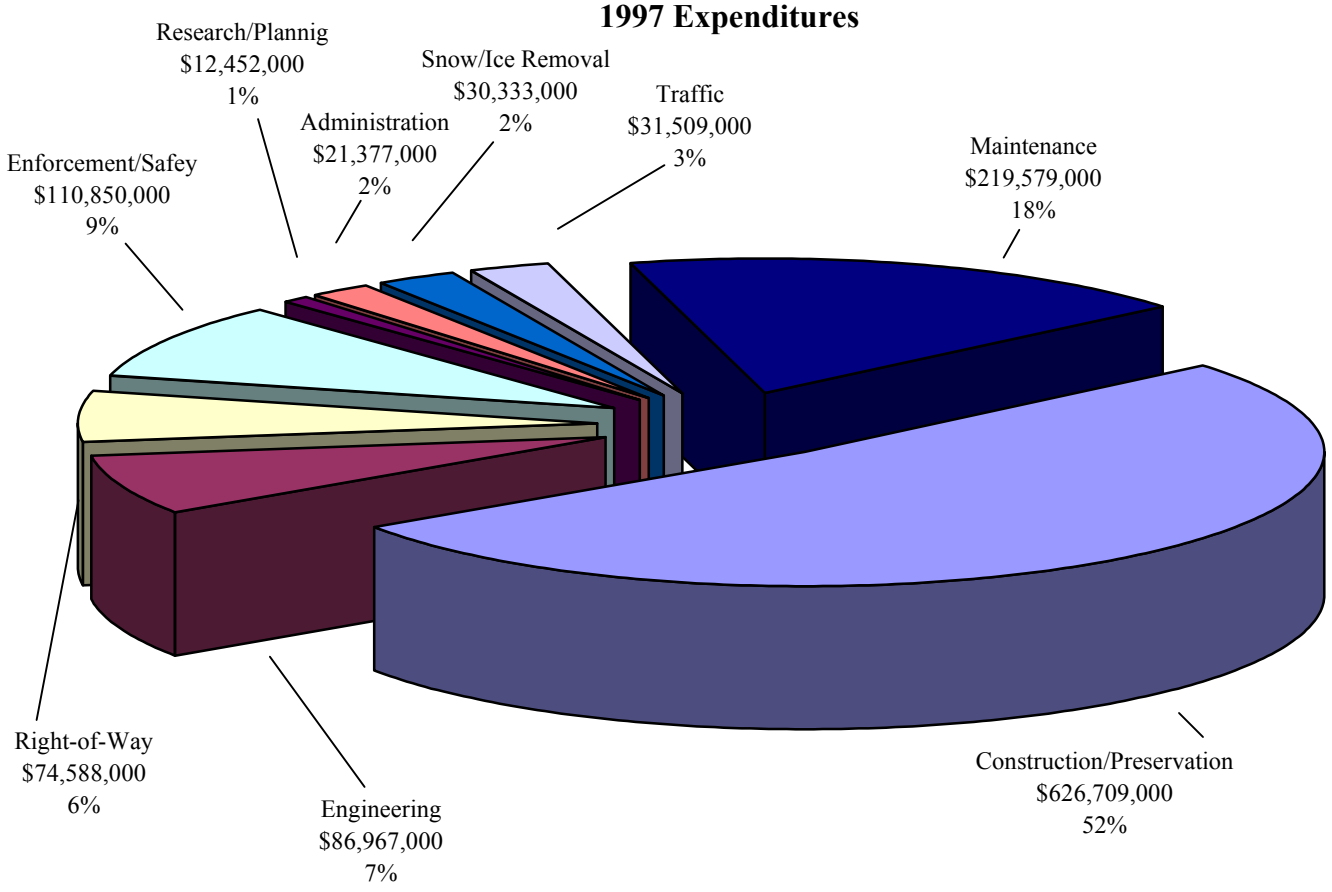
The MoDOT's highway expenditures for 1999, 1998, 1997, and 1996 are presented below:

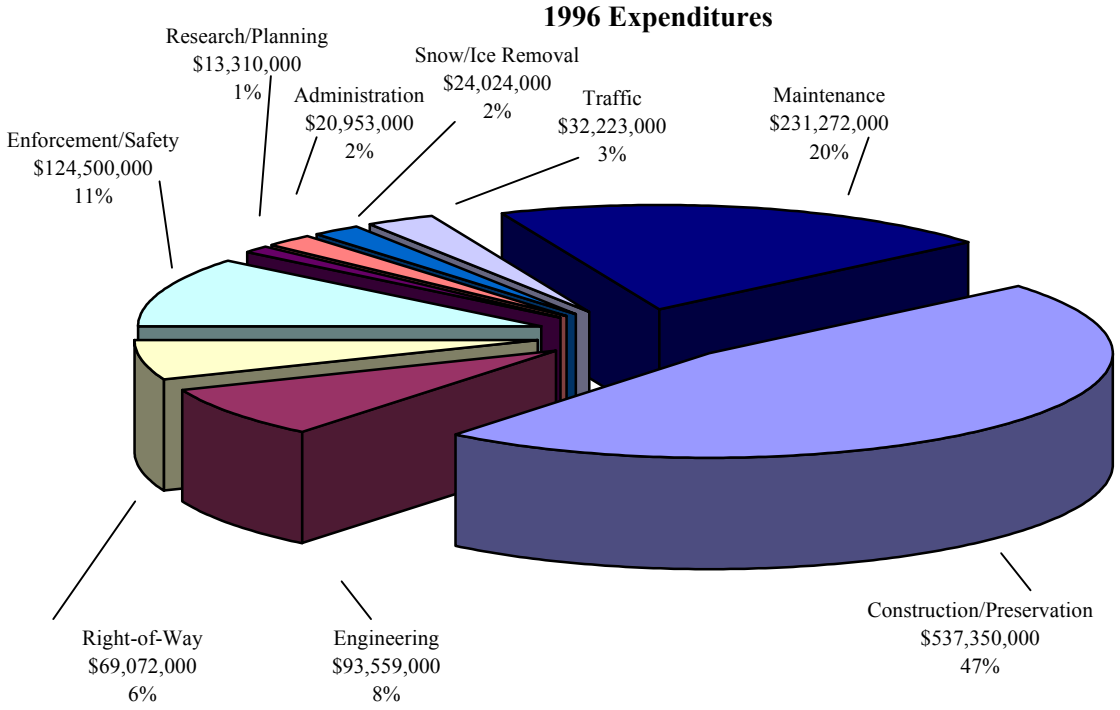


1998 Expenditures



1997 Expenditures

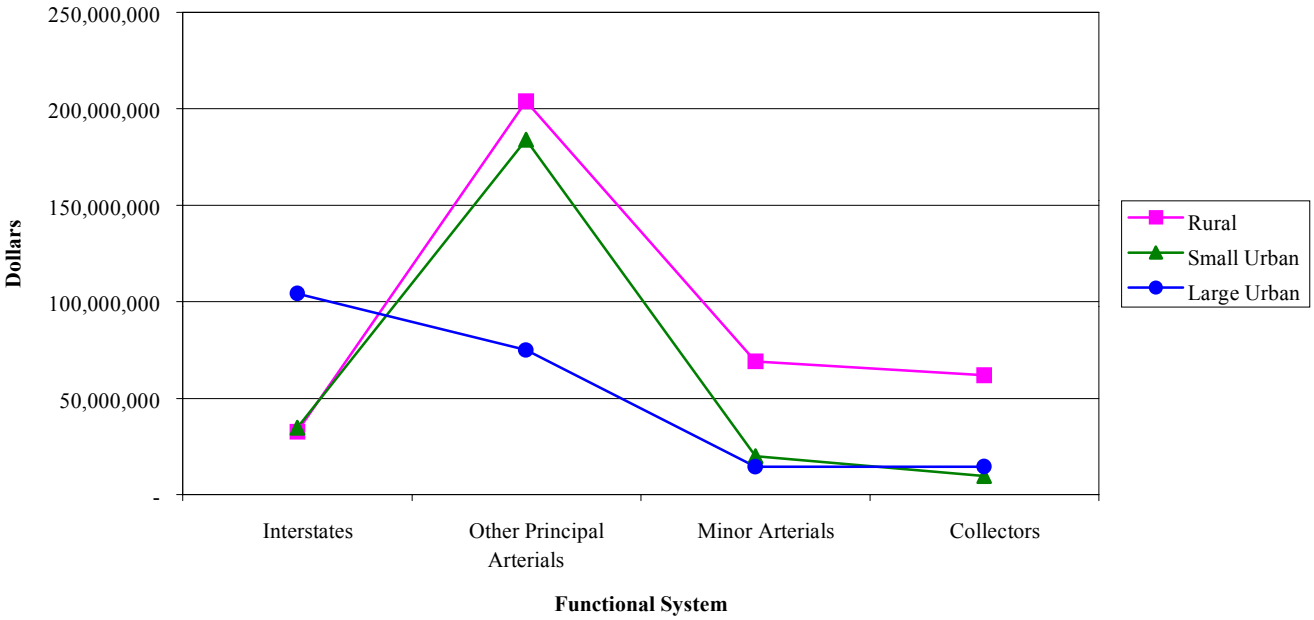




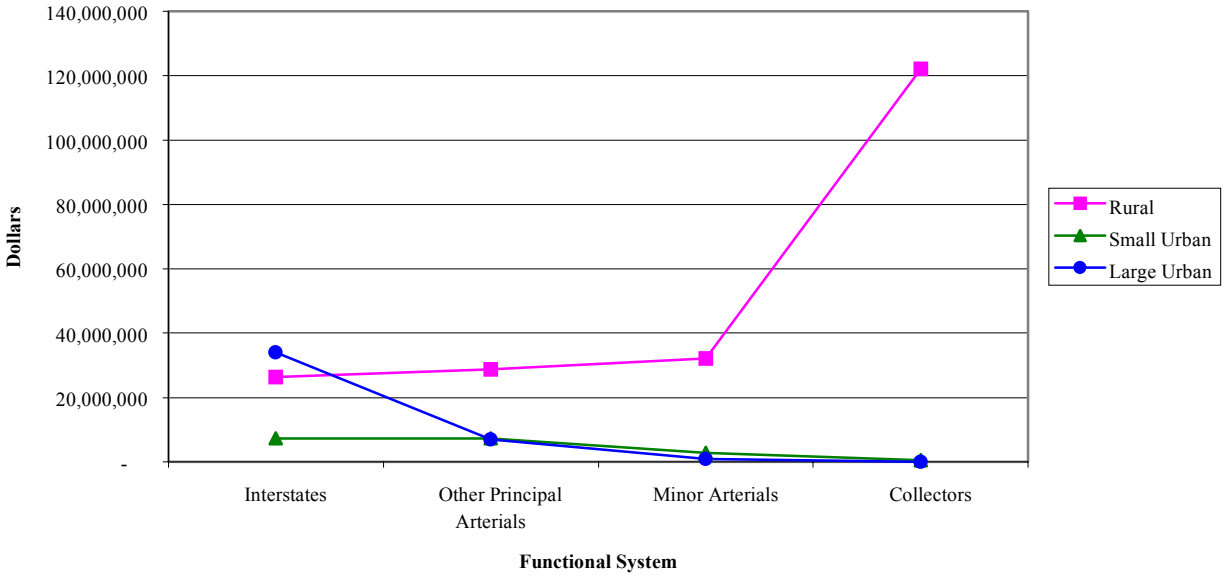
There was not much fluctuation in the percentage of funding allocated to each expenditure classification from 1996 to 1999. The FHWA considers construction/preservation, engineering, and right-of-way to be capital outlay. In 1999, capital outlay and maintenance costs represented approximately 62 and 21 percent of MoDOT's total expenditures, respectively.

The chart below, presents where the capital outlay and maintenance expenditures were incurred in 1999, by functional system and by rural and urban areas. Functional classification defines the role that a particular public road plays in serving the flow of trips through a highway system. For example, interstates are divided expressways for through traffic; other principal arterials (excluding interstates) represent other major roadways serving high-speed, long distance travel; minor arterials emphasize mobility and provide more property access than principal arterials; collector facilities collect and dispense traffic for trips within neighborhoods and between small cities. Small urban areas are defined as areas with a population of 5,000 to 49,000, and large urban areas have a population greater than 50,000.

1999 Capital Outlay Expenditures by Functional System



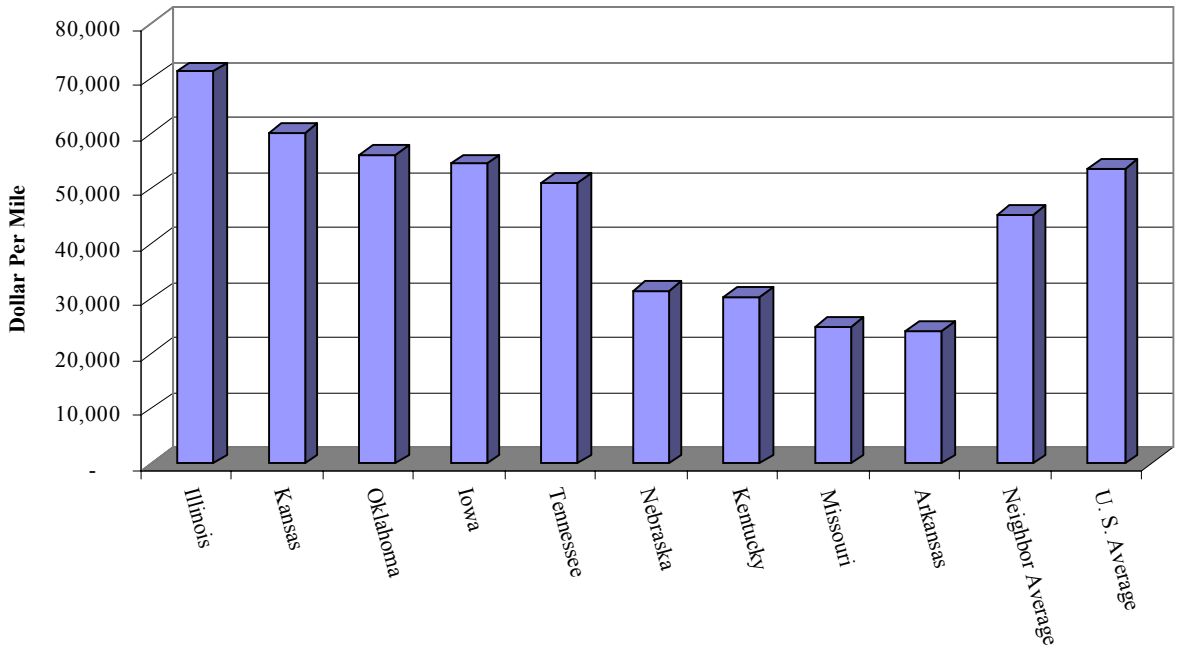
1999 Maintenance Expenditures by Functional System



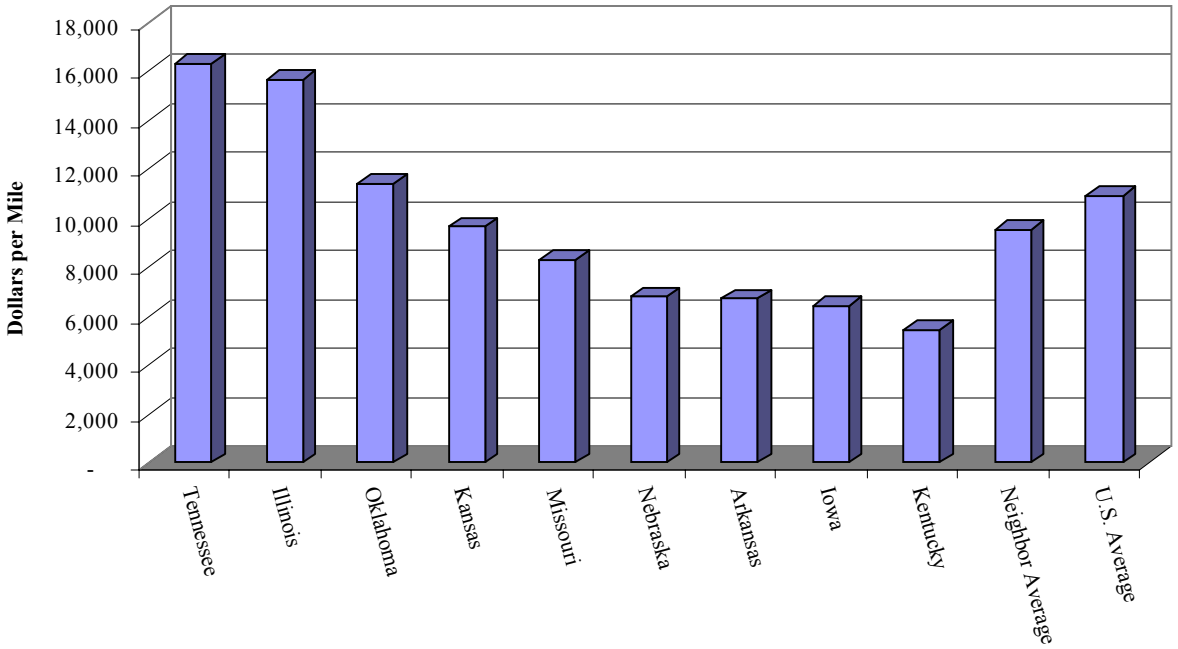
It appears that capital outlay expenditures for the interstate system are approximately the same for rural and small urban areas, with over double that amount spent in large urban areas. However, over 50 percent of total capital outlay was for other principal arterials, with the majority of these expenditures in rural and small urban areas. About 25 and 46 percent of the maintenance expenditures was for the interstates and collectors, respectively. The majority of the interstates' maintenance costs were spent in the rural and large urban areas, while the collector maintenance costs were spent in the rural areas.

2. According to the FHWA, the "purpose of maintenance is to offset the effects of deterioration from age, weather, use, damage, failure, and design and construction faults." Maintenance expenditures include not only preventive maintenance but also general maintenance activities. State maintenance expenditures per mile can vary between states depending upon a number of factors including differences such as climate and geography, how each state defines maintenance versus capital outlay expenditures, traffic intensity and percent of trucks using the system, degree of urbanization, types of pavements being maintained, and the level of system responsibility retained by the state versus that given to other levels of government. A comparison of Missouri's capital outlay and maintenance expense per mile to the neighboring states and the nation for 1999 from the FHWA's Highway Statistics report is presented below:

1999
Capital Outlay Costs Per Mile



1999
Maintenance Costs Per Mile

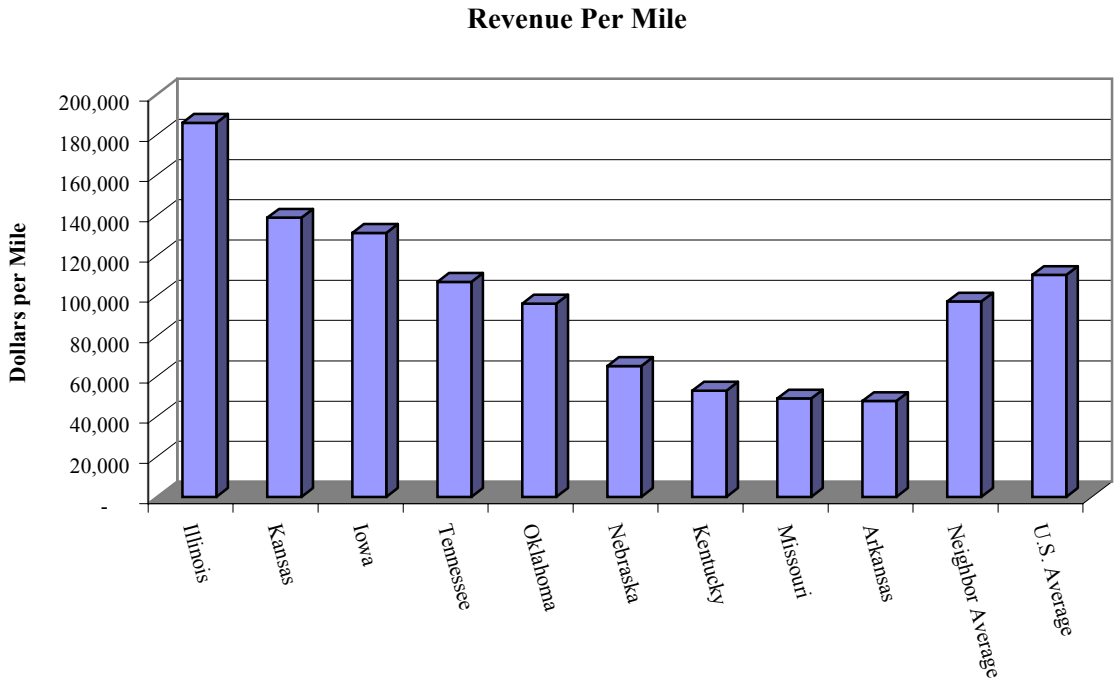


Compared to the neighboring states, Missouri had the second smallest capital outlay expenditures per mile and only four neighboring states spent less money on maintenance costs per mile than Missouri.

From 1996 to 1999, Missouri generally spent less money, on a per mile basis, on its roads and bridges than the neighboring states and the nation-wide average. This is at least partly due to Missouri being responsible for a larger highway system than the neighboring states and for one of the largest in the nation.

C. Funding

1. According to the FHWA's Highway Statistics reports, highway revenues of the various states include highway-user revenues, bond proceeds, federal funds, etc. that are expended for highway purposes. Taxes and fees imposed on the owners and operators of motor vehicles for their use of public highways are highway-user revenues, and include toll fees, motor fuel taxes, motor vehicle registration fees, driver license fees, etc. In 1999, Missouri received over $1.5 billion in highway revenues, or approximately $49,000 per mile. We compared Missouri's revenue per mile to the neighboring states and the nation for 1999 as presented below:

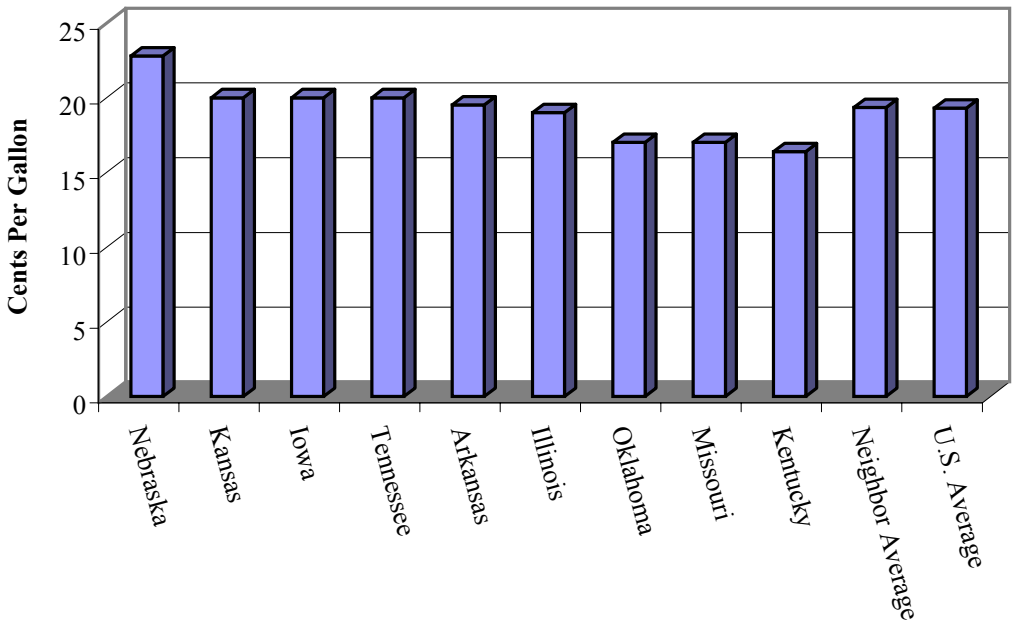


All neighboring states except Arkansas received more funds for highway purposes than Missouri, and Missouri was well below the national average of $110,255 per mile. It should be noted that some neighboring states had a source(s) of highway revenue not being received by Missouri. For example, toll fees were collected in

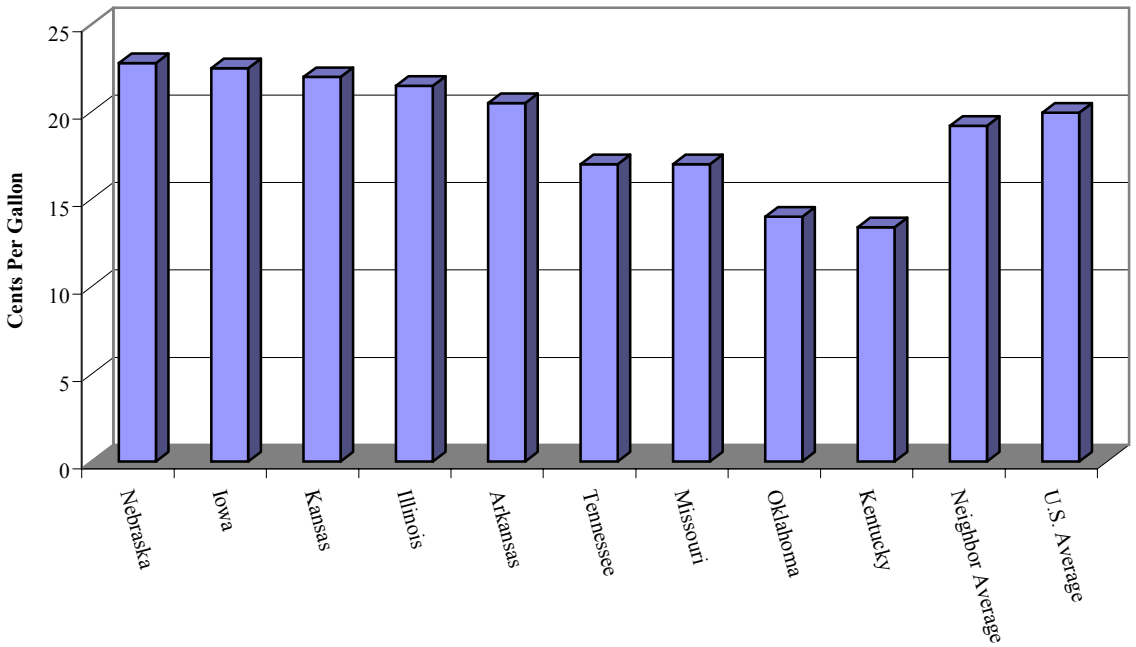
Illinois, Kansas, Kentucky, Oklahoma, and Tennessee. In addition, Illinois, Kansas, and Oklahoma received funds from bond proceeds.

2. We also compared the motor fuel tax rates for Missouri to the neighboring states and the nation for 1999 as presented below.

Gasoline Tax



Diesel Tax



In 1999, motor fuel tax receipts represented approximately 40 percent of Missouri's total highway revenue. Missouri's motor fuel tax of 17 cents per gallon for both gasoline and diesel is lower than most neighboring states. Only Kentucky's rate, at 16.4 cents per gallon on gasoline, is lower than Missouri's rate. Also, two states, Kentucky at 13.4 cents a gallon and Oklahoma at 14 cents per gallon, have a lower diesel tax than Missouri. Nebraska has the highest motor fuel tax of 22.8 cents per gallon for gasoline and diesel.

Considering the relatively low level of revenue available to MoDOT to allocate to the highway system, Missouri's resources to maintain and improve the state's road system are limited.

D. Preservation/Preventive Maintenance Costs

When reviewing activities to deter deterioration and to maintain the road and bridge infrastructure, we considered MoDOT's preservation projects, as programmed in the department's 5-Year Plans, and preventive maintenance activities. According to relevant transportation literature and MoDOT personnel, when adequate preservation and/or preventive maintenance is not performed, pavement and bridge conditions drop and the costs associated with improvements increase.

The words preservation and/or preventive maintenance, when used in relation to roads and bridges, refer to a wide assortment of activities that range from pavement and bridge deck seals; joint and crack sealing; fairly substantial overlays; and pavement replacement. It is sometimes difficult to determine when activities should be classified as preservation or preventive maintenance. Currently, the department defines preservation as "planned proactive, location specific activities, intended to extend the useful life of existing transportation facilities and are programmed" (on the 5-Year Plan). This definition includes work performed to bring roadways up to current standards, such as the addition of shoulders or pavement widening, but does not include adding lanes. Preventive maintenance is defined by the department as the "planned, proactive and often cyclical, location specific activities that are performed on the good or better components of the system to keep them in that condition as long as possible." Preventative maintenance activities may be performed by the department's maintenance crews or by contractors.

Much transportation literature reports that preservation/preventive maintenance is effective in extending pavement life or improving pavement quality over what it would have been in the absence of preservation/preventive maintenance. The causes of deterioration vary, but include heavy truck traffic, normal aging, freeze/thaw, lack of investment, and insufficient pavement design. Preservation/preventive maintenance of roads and bridges include activities that are performed while a structure is still in good condition. Preservation/preventive maintenance is intended to arrest light deterioration, retard progressive failures, and reduce the need for routine maintenance and service activities, and is generally cyclic in nature (could be different cycle for interstate, primary, urban, secondary roads). It does not significantly improve the load-carrying

capacity of pavements, shoulders, or structures but extends the useful life and improves the level of service. In addition, preservation/preventive maintenance is generally performed on the pavements and bridges to keep moisture out of the pavement subbase or to maintain the ability of the pavement to move due to temperature changes. Some of the benefits of preservation/preventive maintenance on pavements include less cracking, fewer potholes and pavement blowups. Bridge preservation/preventive maintenance can reduce the exposure of bridge components to corrosive de-icing chemicals and maintain the ability of bridge components to expand and contract in response to temperature changes.

The various states' preservation expenditures are included in the capital outlay classification in the FHWA's Highway Statistics reports. Therefore, we were not able to adequately compare Missouri's preservation costs per mile to its neighboring states or the nation. However, in August 1999, the MoDOT conducted a survey of seven of Missouri's eight neighboring states to determine the percentage of funding these states allocated to preservation from their available highway funding. Based on department records, in 1999 and 1998, the MoDOT allocated approximately 32 percent and 21 percent, respectively, of its capital outlay expenditures to preservation. According to the survey responses, the percentage of funding allocated to preservation for the seven neighboring states surveyed were as follows:

Arkansas – does not break down jobs into preservation categories.
Illinois – 98 percent of its current program is spent on preservation.
Iowa – varies, 16 percent of its program was spent on preservation in 1998.
Kansas – 32 percent of its current program is spent on preservation.
Kentucky – varies, 19 percent of its program was spent on preservation in 1999.
Oklahoma – 60 percent of its current program is spent on preservation.
Tennessee – 30 percent of its current program is spent on preservation.

It should be noted that the MoDOT personnel conducting the survey did not define preservation. Therefore, the states may have different activities identified as preservation than Missouri and these percentages of funding allocated to preservation may be misleading. However, based on this survey, it appears the MoDOT has allocated a smaller percentage of funds to preservation activities than several of its neighboring states, even considering the increase in 1999.

From department records, we calculated that preventive maintenance expenditures (done by MoDOT maintenance crews and contractors) totaled approximately $109 million, $89 million, $80 million, and $105 million in 1999, 1998, 1997, and 1996, respectively, and that preservation expenditures (from projects on the department's 5-Year Plans) totaled approximately $260 million, $152 million, $155 million, and $105 million in 1999, 1998, 1997, and 1996 respectively. The MoDOT's average preservation/preventive maintenance expenditures for these years is approximately 26 percent of the department's total capital outlay and maintenance costs.

Overall, it appears the MoDOT spent less money than some of its neighboring states on preservation and preventive maintenance activities. Even though the increase in 1999 was a positive change, it is probably still not doing enough preservation and preventive maintenance work to adequately maintain Missouri's roads and bridges. It appears this has contributed to the relatively poor condition of Missouri's roads and bridges compared to neighboring states.

E. Cost Accounting and Performance Management System

1. MoDOT's system of accounting does not adequately identify detailed cost information related to its preservation and maintenance activities, such as pavement resurfacing, pavement patching/sealing, guardrail repair, striping, etc.

   There is currently some inconsistency in accounting for the same activity. For example, some resurfacing is programmed to be contracted out through the department's 5-Year Plans, while other resurfacing is handled through the department's maintenance division. In addition, maintenance activities can be performed by either department maintenance crews or contractors. Even though these activities are comparable, the related costs are accounted for and classified differently in the department's accounting system. Therefore, the MoDOT is unable to accumulate accurate and complete costs for specific activities from year to year.

   During our review, we attempted to obtain expenditure data related to preservation and preventive maintenance costs from the department; however, this information was not readily available. To accumulate this information, it was necessary for us to request several different reports from different data bases.

   The MoDOT needs to consider activity based cost accounting to accumulate preservation and maintenance costs. Activity based costing provides useful information on the costs of performing activities and would help the department to determine how effectively resources are being used and how all activities contribute to the condition of roads and bridges. In addition, this type of accounting could be used to develop internal budgets as well as measuring performance. Without a system of adequately accounting for the various preservation and maintenance activities, the MoDOT has no clear picture of where funds are spent; where modification of spending needs to be implemented; and lessens the opportunity for the MoDOT to control the cost-efficiency of its resources.

2. The MoDOT has not established a system of performance goals and measures for its preservation and maintenance activities, nor has the department developed a means of correlating funding to the needs in the various districts. Performance measures are a component of the information needed to assess accountability and make decisions. The tasks of allocating resources and assuring effective services at reasonable costs are made easier by meaningful and accurate performance

information. Performance measures should be reported for the activities the MoDOT is responsible for providing, whether the department performs the activity itself or contracts for it.

Performance measuring systems provide accomplishment measures that report the resources used (inputs) and what was achieved with those resources. There are two types of accomplishment measures: outputs that measure the quantity of services provided and outcomes that measure the results of providing those outputs. For example, a measure of resources used (inputs) might include the amount spent per lane-mile of road on road maintenance or the number of maintenance workers per lane-mile. An output measure could include the number of lane-miles of road repaired or the percentage of lane-miles of road repaired to a certain minimum satisfactory condition. An outcome measure could include the percentage of lane-miles of road in excellent, good, or fair condition. Performance information should also include comparative information, such as comparison of data with earlier year(s); comparisons to established targets; externally established standards/norms; or other comparable entities. In addition, performance information should be reported consistently from period to period to allow a basis for comparing performance over time and to gain an understanding of the measures being used and to evaluate any trends noted. Performance information must be derived from a system that produces controlled and verifiable data.

Currently, districts spend their preservation and maintenance funding with no goals regarding a level of performance to be achieved. Historically, the internal budgets for the districts are increased each year by a set percentage. Our review of the condition of roads and bridges by district in conjunction with the preventive maintenance expenditures by district disclosed that this method of funding did not always ensure that districts with the most needs (higher percentage of roads and bridges rated as fair or worse) received more funding and/or spent more on preventive maintenance activities than a district with lower needs. For example, in 1999, one district had a larger percentage of roads and bridges rated as fair and worse than most of the other districts; however, five other districts spent more on preventive maintenance activities. In addition, one district spent more funds on preventive maintenance activities than the other districts; however, about half of the other districts had greater needs.

A performance management system would enhance the MoDOT's ability to evaluate whether the resources dedicated to preservation/maintenance are producing desired results, and could help establish desired outcomes for the district's internal budgets.

We were informed the department is preparing a Needs Study and Long Range Transportation Plan (draft of report released September 2000) and an Investment Strategy Plan, which will address road and bridge needs and will establish performance measures for the department's 5-Year Plan. The MoDOT needs to

link the 5-Year Plan performance measures with a performance management system for preservation and maintenance activities.

Missouri's roads and bridges are deteriorating and generally are in worse condition than those in neighboring states. To a large extent, this appears attributable to the fact that Missouri is responsible for one of the largest highway systems in the nation and receives less revenues for highway purposes and expends less money (on a per mile basis) than its neighboring states. However, MoDOT may not be applying a sufficient percentage of its revenues in preserving and maintaining the state's existing infrastructure system. In addition, MoDOT's accounting system does not provide complete and accurate information regarding its preservation and maintenance activities, nor has the department established a system of performance goals and measures related to these activities.

WE RECOMMEND the MoDOT work with the legislature to explore the possibilities of increasing the revenues available for highway purposes. In addition, MoDOT should increase the level of funding allocated for preservation and preventative maintenance activities to improve and maintain the condition of Missouri's existing roads and bridges. Also, the department needs to implement a system of activity based accounting to accurately accumulate and report preservation and maintenance costs and establish a system of performance goals and measures related to these activities.

AUDITEE'S RESPONSE

Transportation funding was the department's number one legislative priority during the 2001 legislative session and will be again for the upcoming 2002 session. Additionally, the 2002-2006 Statewide Transportation Improvement Plan, formally approved by the MHTC in July, reflects MoDOT's change in philosophy to dedicate more funds to rehabilitation and reconstruction of the existing state highway system.

Maintenance costs are accurately reflected in MoDOT records. However, MoDOT continues to improve it's accounting and reporting capabilities and additional detailed breakdowns of maintenance costs will be evaluated for future system enhancements. Our first priority in this area is to assure we maximize the designed accounting and reporting benefits in the state's SAM II accounting system. Once that is achieved, additional systems such as Activity Based Costing and Activity Based Management can be objectively evaluated, the appropriate cost/benefit analysis performed and sound purchasing decisions made.

MoDOT has completed development of performance indicators for maintenance of the state highway system, including a process to collect and compile the necessary data. Data collection took place in June and July 2001 and is currently being complied. The first report of the performance indicators will be available in fall 2001.

This report is intended for the information of the department's management and other applicable government officials. However, this report is a matter of public record and its distribution is not limited.

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